Proposed Plan for Tank Farm Soil and Groundwater at the Idaho Nuclear Technology and Engineering Center, Operable Unit 3-14

U.S. Department of Energy
U.S. Environmental Protection Agency
Idaho Department of Environmental Quality

Idaho Cleanup Project at the Department of Energy's Idaho National Laboratory   August 2006

Figure 1. Aerial view of the INTEC tank farm from the north.

Public Comment Period

August 22 – September 21, 2006

Public Meetings

August 29 – 6 to 8 p.m.
Shilo Inn, Idaho Falls

August 30 – 6 to 8 p.m.
Taylor Student Union Building,
College of Southern Idaho, Twin Falls

How You Can Participate:

Read this Proposed Plan and review related documents in the Administrative Record.

Call the State of Idaho, EPA, or DOE to get more information.

Attend a public meeting to learn more, ask questions, and tell us what you think.

Comment on this Proposed Plan by using the postage-paid comment form on the back cover.

See page 22 for more information about public involvement and contact information.

INTRODUCTION

The U.S. Department of Energy (DOE) has completed the investigation of Operable Unit (OU) 3-14 tank farm soil and groundwater at the Idaho National Laboratory (INL) in southeastern Idaho. OU 3-14 consists of a group of contaminated soil sites located in and around the Idaho Nuclear Technology and Engineering Center (INTEC) tank farm (see Figure 1 above and Figure 2 on following page) and the groundwater in the Snake River Plain Aquifer affected by INTEC releases (referred to as INTEC groundwater).

The Operable Unit 3-14 investigation concluded that contaminated soil inside the tank farm boundary would pose unacceptable risks to unprotected workers. INTEC groundwater is predicted to exceed Idaho groundwater quality standards, which are equivalent in concentration to the federal drinking water standards, for more than 100 years if no action is taken. Remedial action is required to protect future workers and the Snake River Plain Aquifer.

Inside this Plan

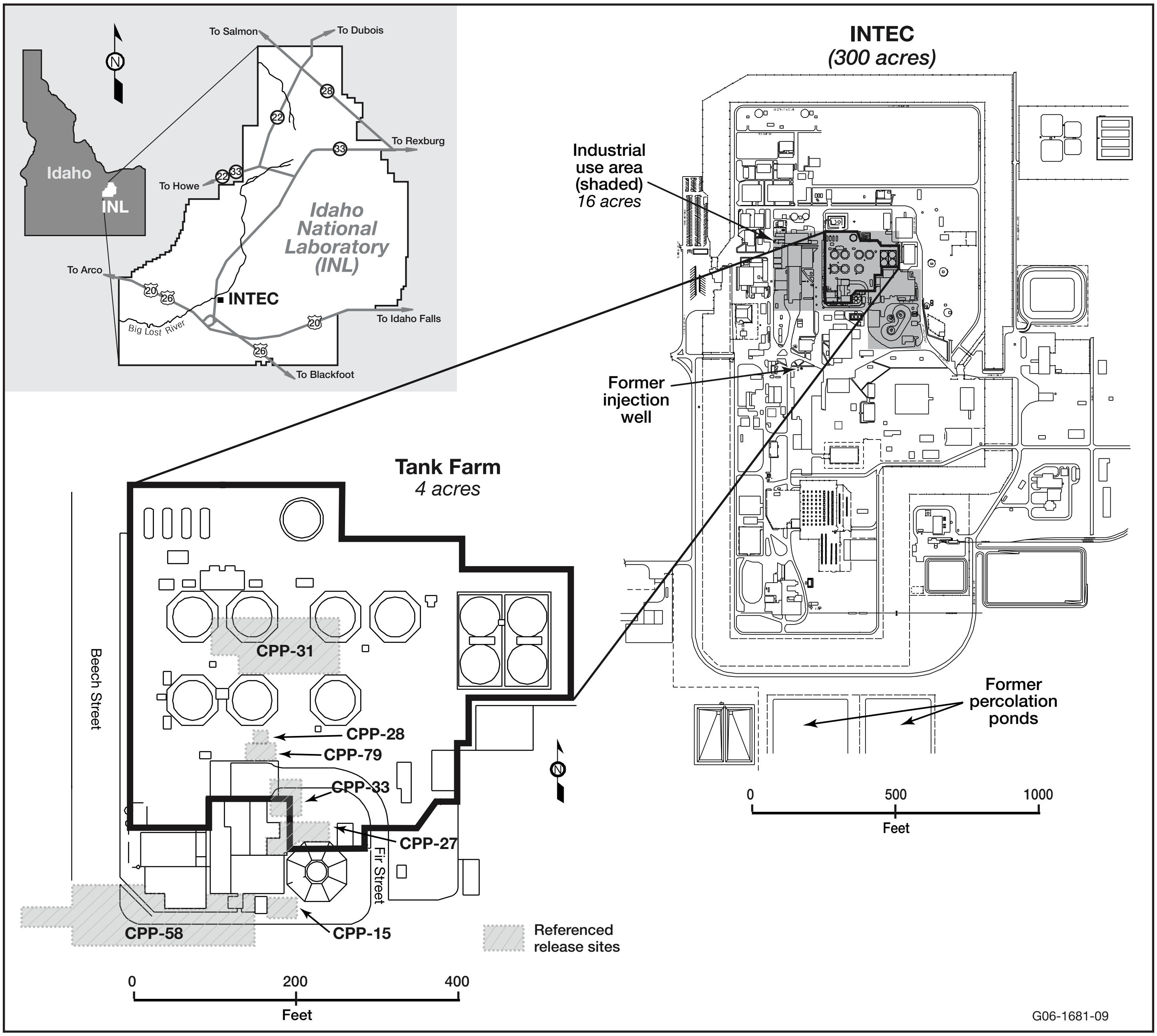


Figure 2. Location map of INL, INTEC, tank farm, industrial use area, and referenced release sites.

NOTE: When technical or administrative terms are first used, they are printed in ***bold italics*** *and explained in the margin. Referenced documents are listed at the end of this Proposed Plan.*

info indicates additional information.

remedial investigation/baseline risk assessment (RI/BRA)
A study that identifies which contaminants are present in an area and assesses the risk they pose to human health and the environment if no remedial action is taken and if workers are unprotected.

This plan summarizes the results of the ***remedial investigation/baseline risk assessment (RI/BRA)***[1] and ***feasibility study (FS)***[2] that investigated tank farm soil and INTEC groundwater. It describes the contamination that requires cleanup, explains the set of alternatives for remedial action that has been developed, and evaluates how well each alternative would perform. A preferred alternative is identified and the reasons for the preference explained. The information contained in this plan is provided so that the public can review and comment on the proposed alternatives to remediate tank farm soil and INTEC groundwater. This document is issued to facilitate public involvement in the remedy selection process.

Three government agencies are involved in cleanup activities at the INL. The U.S. Department of Energy (DOE) is the lead agency responsible for cleanup activities. The U.S. Environmental Protection Agency (EPA) and the State of

Idaho Department of Environmental Quality (DEQ) provide regulatory oversight. Together, the three are referred to as the ***Agencies***.

EPA and DEQ concur with the preferred alternative identified by DOE and presented in this plan. This Proposed Plan is based on information presented in the Remedial Investigation/Baseline Risk Assessment[1] and Feasibility Study.[2] These and other documents used by the Agencies to reach this recommendation are contained in the ***Administrative Record***. The Agencies encourage the public to review these documents for a more comprehensive understanding of the INL and the ***Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)*** activities that have been conducted at the INL.

A final remedy will be selected for the tank farm soil and INTEC groundwater after reviewing and considering all information submitted during the 30-day public comment period for this Proposed Plan (August 22 through September 21, 2006). Comments may be submitted as described on page 22. In selecting the final remedy, the Agencies may modify the preferred alternative presented in this Proposed Plan based on public comments or new information that becomes available after this plan is released. The public is encouraged to review and comment on the alternatives presented in this Proposed Plan. Public comments and the Agencies' responses will be published in the Responsiveness Summary section of the ***Record of Decision (ROD)***, which is scheduled for completion in 2007.

SCOPE AND ROLE OF THE ACTION

The tank farm remedial action is part of the Idaho Cleanup Project (ICP) at the INL. The INL was placed on the ***National Priorities List***[3] of hazardous waste sites in 1989. In 1991, the Agencies signed a ***Federal Facility Agreement and Consent Order (FFA/CO)***[4] outlining the remedial decision-making process and schedule for the INL. Under the terms of the FFA/CO, DOE will carry out the cleanup and pay for all costs associated with it.

A comprehensive Record of Decision for INTEC (Operable Unit 3-13) was completed in 1999.[5] As part of the OU 3-13 Record of Decision, the Agencies determined that they needed more information and created Operable Unit 3-14 to conduct further investigations and select a final remedy for tank farm soil and INTEC groundwater. Information needed for Operable Unit 3-14 included

- The nature and extent of contamination in tank farm soil and its impact on groundwater
- Whether the former injection well, which was used from 1953 to 1986, was a continuing source of contamination to groundwater
- How the disposition of the waste in the tank farm tanks (an Environmental Impact Statement[6] was being prepared at the time) would affect the decision for contaminated soil surrounding the tanks
- Whether contaminated soil had been used as backfill in the tank farm.

After additional investigations were completed on the former injection well, an Explanation of Significant Differences[7] to the 1999 Record of Decision for Operable Unit 3-13 transferred the well back into Operable Unit 3-13. The investigations determined that the former injection well was not a continuing source of contamination to groundwater. However, as a former contaminant source, the impact of the well on groundwater was considered with all other OU 3-13 sources under the OU 3-14 investigation of groundwater.

feasibility study (FS)
An engineering study using CERCLA methods to screen remedial technologies and develop, evaluate, and compare remedial options.

Agencies (DOE, EPA, and DEQ)
DOE is responsible for the cleanup actions for the Idaho Cleanup Project. EPA and DEQ are support agencies and are responsible for regulatory oversight. The Agencies are issuing this Proposed Plan as part of their public participation responsibilities under Section 300.430(f)(2)[8] of the National Contingency Plan (NCP) for responding to releases and threatened releases of hazardous substances, pollutants, or contaminants.

Administrative Record (AR)
The collection of information, including reports, public comments, and correspondence, used by the Agencies to select a cleanup action. A list of locations where the Administrative Record is available appears on page 21.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
The federal law, also known as "Superfund," that establishes a program to identify, evaluate, and remediate sites where hazardous substances may have been released (leaked, spilled, or dumped) to the environment.

Record of Decision (ROD)
A legally binding public document that identifies the remedy that will be used at a group of sites and why. The Responsiveness Summary in the Record of Decision contains the public comments received on the proposed actions and the Agencies' responses.

National Priorities List (NPL)
The formal list of the nation's hazardous waste sites that have been identified for possible remediation (cleanup). Sites are included on the list because of their potential risk to human health and the environment.

Federal Facility Agreement and Consent Order (FFA/CO)
An agreement among the DOE, the EPA, and the State of Idaho to evaluate potentially contaminated sites at the INL, determine if remediation is warranted, and select and perform remediation, if necessary.

Resource Conservation and Recovery Act (RCRA)
A federal waste management law. Its guidelines regulate transportation, treatment, storage, and disposal of waste. RCRA waste includes material that is listed on one of EPA's hazardous waste lists or meets one or more of EPA's four characteristics of ignitability, corrosivity, reactivity, or toxicity.

Hazardous Waste Management Act (HWMA)
Idaho has adopted statutes and rules governing management of certain aspects of hazardous and solid waste. Under HWMA, the Idaho Department of Environmental Quality is authorized by the Environmental Protection Agency to implement the RCRA requirements.

Chemical Processing Plant (CPP)
CPP is a former name for INTEC.

spent nuclear fuel
Irradiated fuel from a nuclear reactor that is no longer useful as fuel. Spent nuclear fuel is thermally hot and highly radioactive.

basalt
Rock that originated as lava extruded onto the earth's surface from a volcanic fissure or vent. Over time, basalt flows may become buried by sediments and subsequent flows.

alluvium
Unconsolidated sediments consisting of gravel, sand, and silt, referred to as soil in this plan.

perched water
Water that accumulates above a low-permeability layer, which slows its downward movement. It is separated from the underlying groundwater by unsaturated rock and sediment.

interbeds
Thin layers of silt, clay, sand, and/or gravel.

radionuclides
An unstable form of an element that becomes stable by giving off excess energy (decay) in the form of radioactivity (rays or particles). Prolonged exposure can be harmful.

Operable Unit 3-14 is collocated within an operating ***Resource Conservation and Recovery Act (RCRA)*** facility. The closure of the tank system (emptying, cleaning, and grouting in place) is being performed in phases in accordance with an Idaho ***Hazardous Waste Management Act (HWMA)/RCRA*** closure plan. DOE must cease use of the tanks by December 31, 2012. Operable Unit 3-14 activities for the contaminated soil surrounding the tanks are integrated with, and limited by, ongoing RCRA tank and piping closure activities and operations.

The final action for the tank farm soil and INTEC groundwater that the Agencies will select for Operable Unit 3-14 will prevent current and future exposure of unprotected workers, the public, and the environment to contamination at these sites. The remedial responses described in this plan meet the requirements of CERCLA.

SITE HISTORY

The tank farm is an integral part of the former ***Chemical Processing Plant*** (now INTEC), which was built in 1951 to dissolve ***spent nuclear fuel*** removed from reactors to recover and recycle uranium-235, some of which was used in government reactors to produce material for the nation's atomic weapons program. This recycling, called reprocessing, resulted in by-products including highly radioactive liquid wastes. These wastes were stored underground in the tank farm in stainless steel tanks, concentrated, and/or converted into solids through a process called calcining.

The tank farm consists of underground tanks used to store the radioactive liquid wastes and infrastructure used to transfer, monitor, and control the liquid wastes. The tanks are inside concrete vaults (see Figure 3 on page 5). The vaults sit on top of ***basalt***, which is 40 to 60 ft below ground. The vaults and associated piping are buried in ***alluvium*** (which will be referred to as soil in this plan). Some of the piping and valves outside the tanks and vaults have leaked and contaminated soil, ***perched water***, and groundwater. The major sources of radioactivity in tank farm waste were evaporator bottoms and concentrated by-products from reprocessing spent nuclear fuel to extract and purify the uranium. Some of the leaks that contaminated soil were a result of flaws in piping or valve designs. These flaws were corrected during several major upgrades at the tank farm, which included replacing piping and valves. The leaks occurred between 1954 and 1986. No leaks occurred from the tanks themselves.

The 40 to 60 ft of soil in the tank farm is underlain by thick sequences of basalt flows separated by thin discontinuous sedimentary ***interbeds*** deposited at the former land surface during the intervening periods between ancient volcanic eruptions. Infiltrating water from precipitation, intermittent flow of the Big Lost River, which passes by the northwest corner of INTEC, and releases of INTEC process water have created discontinuous perched water zones. Perched water occurs at depths of approximately 110, 140, and 380 ft below the land surface and is contaminated with ***radionuclides***. The contamination originated from INTEC activities and from the former INTEC injection well. Originally, the well released wastewater directly into the aquifer. Later, the well casing corroded and the well also released wastewater above the aquifer.

The Snake River Plain Aquifer is approximately 465 ft below the tank farm surface and is among the nation's most productive aquifers. Groundwater generally flows southwest beneath INTEC. The Snake River Plain Aquifer is contaminated by radionuclides from INTEC activities, including disposal of approximately 12 billion gallons of wastewater to the former injection well, and tank farm liquids that leaked to the soil and migrated to the aquifer. Concentrations of strontium-90, technetium-99, iodine-129, and nitrate in the Snake River Plain Aquifer beneath INTEC currently exceed Idaho groundwater quality standards in one or more monitoring wells.

The current strontium-90 and iodine-129 contamination is primarily from direct injection of wastewater into the aquifer down the former injection well. For strontium-90, the extent of contamination that exceeds the Idaho groundwater quality standard in the aquifer (which will be referred to as a plume in this plan) is 1½ miles long and extends ¾ of a mile southwest of INTEC. The plume is entirely within the INL and is over 7 miles from the southern INL boundary. Annual groundwater monitoring data show that the leading edge of the plume has been gradually receding back toward INTEC and away from the INL boundary since use of the former injection well was discontinued in 1986. Iodine-129 exceeds Idaho groundwater quality standards in one monitoring well, which is located inside INTEC.

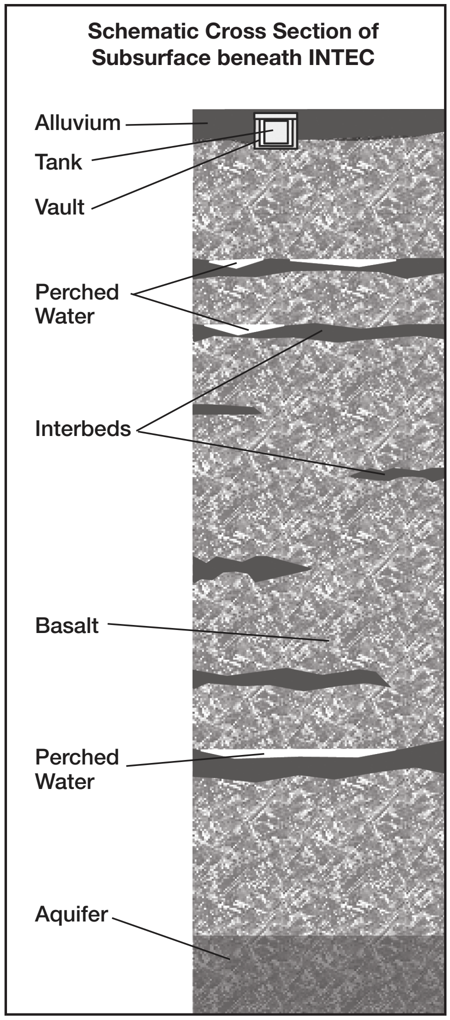


Figure 3. Schematic of the tank farm subsurface.

For the Operable Unit 3-14 contaminants, the EPA standards for drinking water are numerically the same as the Idaho groundwater quality standards. The Idaho standards will be referred to in this plan.

Tank farm soil release site CPP-31 (see Figure 2 on page 2) was likely the primary source of the current technetium-99 and nitrate plume in the Snake River Plain Aquifer. The release of liquid waste at CPP-31 also resulted in high concentrations of strontium-90 in perched water under INTEC. Perched water is not a drinking water source; however, clean water infiltrating through the contaminated perched water and interbed sediments mobilizes strontium-90 and can carry contamination downward. Water infiltration must be reduced to protect the underlying Snake River Plain Aquifer. Perched water and aquifer monitoring at INTEC and infiltration controls to reduce perched water, such as moving the INTEC percolation ponds and sewage treatment infiltration galleries, eliminating lawn watering, and installing lined ditches and collecting runoff, have been ongoing under Operable Unit 3-13. A final remedy for perched water and an interim action for groundwater inside the INTEC fence and the tank farm soil were selected under the OU 3-13 Record of Decision. A final remedy for INTEC groundwater and tank farm soil will be implemented under OU 3-14.

All soil release sites are assigned a number to aid in tracking information about each site (such as CPP-31). The CPP prefix indicates that the sites are located at INTEC.

SITE CHARACTERISTICS

An investigation into the nature and extent of contamination for each Operable Unit 3-14 site was performed. In 2004, holes were drilled into the tank farm soil down to basalt, measurements of radioactivity made, and samples collected for analysis in a laboratory. An extensive search of historical operational records and reports was conducted and personnel intimately familiar with tank farm operations, history, and process knowledge reviewed these records. A conceptual model of each spill or leak and an estimate of the volume and composition of the contaminated liquid released were developed. Historical and new soil concentration data were evaluated to support and/or refine the conceptual model of releases at each site.

curies (abbreviated as Ci)
A unit used to describe the intensity of radioactivity in a sample of material. It is equal to 37 billion atoms disintegrating per second, which is the radioactivity of a gram of radium.

Approximately 18,000 ***curies*** (Ci) of strontium-90, 19,000 Ci of cesium-137, 15.5 Ci of technetium-99, 1 Ci of iodine-129, and 2,850,000 kilograms (kg) of nitrate are estimated to have been released into Operable Unit 3-14 soil and the former injection well. Table 1 shows the relative percentage that each of these sites contributed. The former injection well accounted for a large percentage of the total technetium-99 and nitrate released, but the wastewater concentrations were relatively low. However, monitoring results indicate that the current plume in the Snake River Plain Aquifer that exceeds Idaho groundwater quality standards for technetium-99 and nitrate likely came from the tank farm sources, rather than the former injection well. The contaminants in the tank farm releases were much more concentrated than in the injection well.

Table 1. Comparison of selected contaminant sources and their relative contributions (see Figure 2 on page 2).

	Contaminants of Concern				
Site	Strontium-90	Cesium-137	Technetium-99	Iodine-129	Nitrate
CPP-31	87%	87%	21%	<1%	<1%
CPP-28, CPP-27/33, CPP-79 (deep)	12%	12%	2%	<1%	<1%
All other OU 3-14 sites	<1%	<1%	<1%	<1%	<1%
Former injection well	<1%	<1%	77%	99%	99%
Total	18,000 Ci	19,000 Ci	15.5 Ci	1 Ci	2,850,000 kg

sodium-bearing waste (SBW)
Liquid waste that contains radioactive and hazardous constituents produced primarily from the decontamination of high-level waste facilities and the second and third cycles of spent nuclear fuel reprocessing at INTEC. It is chemically and radioisotopically similar to high-level waste, but is generally much less radioactive (10 to 1,000 times less). Sodium-bearing waste is very acidic and has high concentrations of sodium and potassium nitrates.

first-cycle waste
A term used to describe the radioactive liquid waste generated during the first cycle in a solvent extraction system used for direct reprocessing of spent nuclear fuel. When originally generated, first-cycle waste is classified as high-level waste.

As shown in Table 1, CPP-31 was by far the largest radionuclide release in Operable Unit 3-14. The leak occurred in 1972 when approximately 18,600 gallons of ***sodium-bearing waste*** leaked during an unsuccessful transfer from one underground tank to another. The acidic solution accidentally backed up into a carbon steel pipeline, corroded the pipe, and leaked into the soil. CPP-31 accounts for over 87% of the total strontium-90 and cesium-137 released at the tank farm. CPP-28, CPP-27/33, and CPP-79 (deep) account for about 8 to 12% of these same contaminants, and the remaining OU 3-14 soil sites account for less than 1% of the radionuclides. Sampling data show that cesium-137 and strontium-90 remain in the soil and that a portion of the strontium-90 has moved downward into the underlying perched water and interbed sediments. Strontium-90 concentrations in the perched water decrease with depth. There is no evidence that the strontium-90 from the tank farm releases has yet reached the Snake River Plain Aquifer. The former INTEC injection well accounted for almost all of the iodine-129 released at INTEC, but less than 1% of the strontium-90 and cesium-137. Although the former injection well was a small percentage of the total strontium-90 released at INTEC, it caused the current strontium-90 plume in the aquifer because the waste was injected directly into the aquifer.

CPP-28 was a release in the early 1970s of 230 gallons of ***first-cycle waste*** from a waste transfer line that had a hole accidentally drilled in it during construction. CPP-79 (deep) was a release in the late 1960s to early 1970s of 400 gallons of first-cycle waste, process equipment waste, and sodium-bearing waste when Teflon flange gaskets failed in two valve boxes. Some of the leaking solution went into the tile pipe encasements that penetrated the floors of the valve boxes into a horizontal encasement 30 ft below the surface of the tank farm. CPP-27/33 was a release in the mid-1960s of 540 gallons of ***Waste Calcining Facility*** scrub solution. Transfers of this nitric acid solution from the facility to the process equipment waste evaporator backed up into a carbon steel line. The acidic solution dissolved the carbon steel line and leaked to the soil.

Waste Calcining Facility (WCF)
A building where liquid high-level and sodium-bearing waste was turned into a granular solid. The Waste Calcining Facility has been grouted in place and closed under HWMA/RCRA.

The bulk of the contaminated soil at CPP-28 and CPP-27/33 has already been removed. Drilling and sampling into these sites in 2004 as part of the OU 3-14 RI/FS activities confirmed that the high level of contamination associated with these releases was removed and had been replaced with backfill that had much lower levels of contamination.

In addition to the contaminated tank farm soil sites, major construction and maintenance projects inadvertently spread contamination to other areas of the tank farm because contaminated soil was placed back in excavations as backfill. The backfill met requirements for use as backfill in the tank farm but does not necessarily meet the more stringent cleanup criteria under CERCLA. Sampling data collected in 2004, historical records, and photos indicate that soil contaminated by liquid waste releases from the tank farm system had been inadvertently spread to previously uncontaminated areas in the tank farm.

Two sites, CPP-15 and CPP-58, are located just outside the tank farm boundary. CPP-15 was a release of kerosene and condensate from the main INTEC stack when the stack drain line was modified. CPP-58 was caused by leaks from the process equipment waste evaporator pipelines, which contained condensate. More information about these and other releases and previous cleanup from the other OU 3-14 sites can be found in Section 5 of the RI/BRA.[1]

SUMMARY OF RISKS

A baseline risk assessment was previously completed under Operable Unit 3-13[9] and determined that ***unacceptable exposures*** to contamination could potentially occur in two primary ways: direct exposure to shallow soil at the tank farm and ingestion of contaminated water. The risks from all other exposure routes were determined to be acceptable. The OU 3-14 risk assessment focused on these primary exposure routes, as well as updated the ecological risk assessment.

unacceptable exposures
The CERCLA process assesses the increased risk of developing an additional cancer (called ***excess cancer risk***, which is defined on page 8) in a person's lifetime from exposure to contamination. If the risk is greater than 1 in 10,000, the Agencies consider the risk unacceptable.

INTEC, which occupies 300 acres, has an established industrial infrastructure. The tank farm is located in the middle of an active part of this facility. It is anticipated that it will take approximately 30 years to decontaminate, decommission, and clean up this facility and to have all the solidified radioactive waste ready for shipment out of Idaho. Active underground waste and process pipelines that are essential to the cleanup and closure of INTEC run through the middle of the tank farm. The *Idaho High-Level Waste & Facilities Disposition Final Environmental Impact Statement*[6] discusses current land use plans that include a 100-year institutional control period for INTEC. For OU 3-14, the Agencies agree that DOE will maintain control of the INTEC until at least 2095 and can reliably restrict access and control worker activities during that time.

info The INL is expected to remain under government management and control until at least 2095. After this time, the federal government is obligated to continue to manage and control areas that pose a significant health and/or safety risk to the public and workers until risk diminishes to an acceptable level. For INTEC, the 100 years of federal control was established in 1995.

Soil

Permanent barrier systems (grouted facilities and tanks) exist or are planned in and around the tank farm. The Agencies have determined that future residents cannot reasonably be expected to ever live in the 4 acres of the tank farm or on the 12 acres surrounding the tank farm and that this area will be used as an industrial area (see Figure 2 on page 2) for the foreseeable future. Therefore, a future industrial use scenario (see Section 4.3 of the Remedial Investigation/ Baseline Risk Assessment[1] for more detail) was evaluated in the risk assessment for OU 3-14 contaminated soils. The risks to current and future workers from direct exposure to soil in the top 4 ft at the tank farm were assessed. Four feet is the depth that a worker could reasonably be expected to dig to set footings below the frost line for an industrial building.

excess cancer risk
The increased risk (above the normal rate) of developing cancer resulting from exposure to contaminants at a release site. This does not include the average risk of developing cancer in a lifetime (approximately 4 in 10 people).

Because of the mixing of soil during tank farm excavation projects, all sampling data from surface soil inside the tank farm boundary were used to evaluate the exposure risk over the entire area of the tank farm. The risk assessment assumes the worker is unprotected and exposed to soil for 40 hours each week and 50 weeks each year for 25 years. The calculated risks are much higher than the real risk to workers because actual work assignments are of much shorter duration and workers are protected by radiological work controls. Table 2 summarizes the risk assessment results for all soil inside the tank farm boundary, including contaminated backfill, and for two sites outside the boundary, CPP-15 and CPP-58. Figure 2 (see page 2) shows the locations of CPP-15 and CPP-58.

Table 2. Estimated direct external exposure risk to an unprotected worker from cesium-137 contaminated surface soil.

	Human Health Risk	
Site	Risk to Current Worker (2005)[a]	Risk to Future Worker (2095)[a]
Soil Inside Tank Farm Boundary	***200 in 10,000***	***30 in 10,000***
CPP-15	***7 in 10,000***	0.8 in 10,000
CPP-58	***4 in 10,000***	0.5 in 10,000

Bold Italic *= Risks that exceed acceptable levels, as documented by the remedial investigation.*[1]
a. No chemicals present in the soil pose an unacceptable risk or hazard to human health or the environment.

gamma-emitting radionuclides
Radioactive atoms that emit energy in the form of a ray (an electromagnetic wave similar to an X-ray). Because gamma rays have no charge and no mass, they have a very high penetrating power (they can easily go several hundred feet in air and can penetrate the human body).

radioactive decay
The spontaneous release of radiation by a radioactive atom in order to become stable (nonradioactive).

half-life
The time it takes for one-half of the radioactive atoms to decay. Half-lives range from a fraction of a second to billions of years. After seven half-lives, less than 1% of the original radioactivity remains. The half-lives of cesium-137 and strontium-90 are approximately 30 years.

Using conservative assumptions, the highest potential ***excess cancer risk*** to an unprotected worker posed by the contaminants in the tank farm soil was calculated to be 200 in 10,000. This means that if the contaminated soil is not remediated and the workers are not protected, as many as 200 out of every 10,000 workers exposed to these contaminants could develop cancer as a result of the exposure. This risk is unacceptable because it is greater than the acceptable risk range defined by EPA. The Agencies have historically used an excess cancer risk greater than 1 in 10,000 as the threshold for cleanup at the INL. This unacceptable risk would be from direct exposure to cesium-137, which is a ***gamma-emitting radionuclide***, found at high concentrations in the tank farm soil. At CPP-15 and CPP-58, the risk for an unprotected worker in 2005 was calculated to be greater than 1 in 10,000. No credit was taken in the risk assessment for a concrete pad, which covers CPP-15 and provides shielding from direct radiation exposure. The concrete pad supports a transformer and electrical duct banks, which are needed for another 30 years. In 2095, institutional controls could be lost. After 2095, the risk for an unprotected worker was calculated as less than 1 in 10,000 due to ***radioactive decay*** of cesium-137, which has a ***half-life*** of 30 years.

Groundwater

To predict future concentrations of contaminants in groundwater, computer modeling was used to simulate the fate and subsurface transport of contaminants released from all of the CERCLA sites at INTEC, including the former injection well. Some contaminants, like technetium-99, iodine-129, and nitrate, are very mobile; they move at about the same rate as water. Other contaminants, like cesium-137 and strontium-90, are less mobile; their movement is slowed because they attach to the surrounding soil and rock. Because the sodium-bearing waste released at CPP-31 had unusual chemistry (highly acidic and high in salts), it temporarily made some of the strontium-90 more mobile than normal. Being highly acidic, the waste dissolved naturally occurring salts contained in the soil particles (primarily calcium). The dissolved salts competed with the strontium-90 to attach to the soil. This allowed some of the strontium-90 to migrate rapidly downward to the perched water and interbeds where the chemistry was normal. This reduced the strontium-90 mobility and most of it attached to the interbed sediments.

In the CPP-31 release area, the naturally alkaline soil neutralized the acidic waste. As infiltrating snowmelt and rainwater dissolved and washed away the salts, the binding strength and the chemistry of the soil was restored to normal. Therefore, the strontium-90 remaining in the tank farm soil is bound to the soil, where it is decaying in place. Modeling indicates that some of the strontium-90 that initially migrated to the perched water and interbed sediments could migrate downward to the Snake River Plain Aquifer if remedial action is not taken.

The model predicts that concentrations of all contaminants in the aquifer are trending downward and will continue to decline. Strontium-90 is the only contaminant that is predicted to exceed Idaho groundwater quality standards in 2095 and beyond if no further remedial action is taken to protect groundwater. The water quality standard for strontium-90 is 8 ***picocuries***/liter (pCi/L) and the model predicts that the maximum concentration in the aquifer in 2095 will be 19 pCi/L.

picocurie (pCi)
One trillionth of a curie. See page 6 for definition of curies.

The model predicts that the residual strontium-90 remaining in the tank farm soil is relatively immobile and is an insignificant contributor to the overall risk to the aquifer. Because of this, remedial action on the contaminated soil deeper than 4 ft would not significantly reduce risk to future workers. The model also predicts that most of the strontium-90 has migrated below the soil. Infiltration of precipitation and discharges of clean INTEC process water would likely transport some of the strontium-90 in the perched water and interbed sediments downward. Modeling predicts that if no action is taken to reduce this migration from the perched water, the aquifer would exceed Idaho groundwater quality standards until the year 2129. The current INTEC drinking water supply wells are located upgradient of the contaminated zone. Institutional controls through the year 2095 will ensure that no workers or visitors will ingest contaminated groundwater. Ongoing monitoring of the perched water and groundwater are used to check the accuracy of the model and determine whether additional action is warranted.

Ecological

The ecological risk assessment performed for Operable Unit 3-13 was updated to incorporate new data (see Chapter 7 of the Remedial Investigation/Baseline Risk Assessment[1]). The surface of the tank farm is covered with an impermeable membrane, gravel, and infrastructure, such as buildings, which inhibit plant growth. However, contaminants must be prevented from being transported to the surface (for example by ants or plants) in the future. In addition, the ecological risk assessment concluded a potential exists inside the tank farm for biotic intruders (such as beetles and rabbits) to receive unacceptable internal exposure to the individual contaminants cesium-137 and strontium-90.

info Unacceptable internal exposure to biota would result in the lack of maintenance or recovery of healthy local populations/communities of ecological receptors that are or should be present at or near the site.

REMEDIAL ACTION OBJECTIVES

The remedial action objectives describe what the proposed cleanup is expected to accomplish, based on the risks identified in the Remedial Investigation/Baseline Risk Assessment.[1] Where risks are unacceptable, the remedial action objectives typically lead to either the contaminants being removed, destroyed, or actions taken to protect human health and the environment from risks posed by any contaminants that remain.

Contaminant concentrations at the sites located outside the tank farm, CPP-15 and CPP-58, are lower than in the tank farm and do not pose an unacceptable risk to future workers. CPP-15 has already been remediated to a depth of approximately 10 ft. Biotic intruders are not a concern at these sites.

The remedial action objectives for soil are

1. Prevent external exposure to workers from soil, including preventing biota from bringing contaminants to the surface, that would cause an excess cancer risk greater than 1 in 10,000.
2. Prevent unacceptable internal exposure to biota from soil.

The remedial action objectives for the Snake River Plain Aquifer affected by INTEC sources are

1. Protect human health by preventing ingestion of groundwater from the Snake River Plain Aquifer in concentrations above Idaho groundwater quality standards.
2. Meet Idaho groundwater quality standards in the Snake River Plain Aquifer by the restoration timeframe of 2095 and beyond.

The second remedial action objective for the Snake River Plain Aquifer may require actions on soil, perched water, and/or groundwater.

CERCLA EVALUATION PROCESS

For most sites, several alternatives are available to meet the remedial action objectives. The preferred alternative is identified through an evaluation process that uses criteria defined by CERCLA. The alternative that best meets the criteria is proposed as the final remedy.

The first two evaluation criteria are "threshold criteria": (1) overall protection of human health and the environment and (2) compliance with ***applicable or relevant and appropriate requirements*** (ARARs). An alternative must meet the threshold criteria or it cannot be selected. The next five criteria are "balancing criteria" and are used to weigh major tradeoffs among the alternatives. These criteria are (1) long-term effectiveness and permanence; (2) reduction of toxicity, mobility, and volume through treatment; (3) short-term effectiveness; (4) implementability; and (5) cost. Each alternative is evaluated in terms of how well it satisfies these criteria. The final two criteria are "modifying criteria" that evaluate state and community acceptance concerns. During evaluation, each alternative is first assessed individually against the criteria. A comparative analysis then assesses the overall performance of each alternative relative to the others.

applicable or relevant and appropriate requirements (ARARs)
The body of federal and state laws, regulations, and standards governing environmental protection and facility siting with which the selected alternative must comply. ARARs are either applicable or relevant and appropriate for the situation and must be met when cleaning up sites.

The principal ARARs that the selected alternative for Operable Unit 3-14 must comply with are

- Idaho Ground Water Quality Rule for the Snake River Plain Aquifer
- Clean Air Act and Idaho Air Regulations, which apply to air pollutants and emission standards
- Idaho Hazardous Waste Rules, which apply to waste management activities.

A detailed list of specific ARARs that apply to remediation of these sites is in Section 4.3 of the Operable Unit 3-14 Feasibility Study.[2] In addition, the selected alternative must comply with all DOE requirements, particularly those that deal with radioactive waste management, and radiation protection of workers, the public, and the environment.

Preliminary remediation goals (PRGs) are quantitative cleanup levels that would protect human health and the environment and meet ARARs, risk-based levels, and the remedial action objectives.. The remediation goals are based on the results of the Remedial Investigation/Baseline Risk Assessment[1] and evaluation of expected exposures and risks for selected alternatives. The Operable Unit 3-14 remediation goals will be used to assess the effectiveness of the selected remedial alternatives in meeting the remedial action objectives. A 1-in-10,000 excess cancer risk is the primary basis for determining preliminary remediation goals for the soil. Groundwater preliminary remediation goals are based on meeting the Idaho groundwater quality standards by the year 2095 and beyond. They are 8 pCi/L for strontium-90 and a cumulative dose of 4 ***millirem***/year for total strontium-90, iodine-129, and technetium-99. More information on the PRGs for the soil and groundwater can be found in Section 2 of the OU 3-14 Feasibility Study.[2] Final remediation goals will be documented in the Record of Decision for OU 3-14.

The groundwater model was used to predict when the Idaho groundwater quality standards would be met in the Snake River Plain Aquifer. These results were used in the evaluation process.

preliminary remediation goals (PRGs)
A level of contamination that is considered safe for human health and the environment. The PRGs are established during the feasibility study based on scientific information and are used as a target. Alternatives are developed and evaluated based on how well they meet the PRGs. Final remediation goals are set in the Record of Decision.

millirem (mrem)
Unit of radiation dose used to measure exposure to humans. On average, each person in the U.S. receives 360 millirem of radiation per year from natural and other sources such as medical.

CERCLA Evaluation Criteria

Threshold Criteria

✔ ***Overall protection of human health and the environment***
Does the alternative protect human health and the environment in both the short and the long term by eliminating, reducing, or controlling the risk?

✔ ***Compliance with applicable or relevant and appropriate requirements (ARARs)***
Does the alternative comply with environmental laws?

Balancing Criteria

✔ ***Long-term effectiveness and permanence***
How certain is it that the alternative will be successful? Once cleanup goals have been met, will protection be maintained? What risks do the untreated waste or post-treatment residuals pose? How adequate or reliable are the controls, such as institutional controls, used to manage treatment residuals and untreated wastes?

✔ ***Reduction of toxicity, mobility, or volume through treatment***
How much of the contamination will be treated? What will treatment accomplish? Is the treatment permanent? How much and what type of residuals will remain after treatment?

✔ ***Short-term effectiveness***
Does the alternative pose any risks to the community, workers, or the environment during implementation? How soon will protection be achieved?

✔ ***Implementability***
Is the proposed technology feasible and reliable? Can its effectiveness be monitored? Are the necessary materials, equipment, specialists, and services available?

✔ ***Cost***
What are the estimates for capital costs and for operating and maintenance costs? Are the costs in proportion to the overall effectiveness of the alternative?

Modifying Criteria

✔ ***State acceptance***
Does the state concur with the preferred alternative?

✔ ***Community acceptance***
Which aspects of the alternatives does the public support or oppose?

DESCRIPTION AND EVALUATION OF ALTERNATIVES

The feasibility study process screens remedial technologies and formulates alternatives that will meet the remedial action objectives. Then the alternatives are evaluated in detail and compared to determine how well they meet the CERCLA criteria.

Development of Alternatives

The feasibility study evaluated alternatives to address:

- The top 4 ft of soil over the entire tank farm
- All of the contaminated soil down to basalt for CPP-31 (the primary source of cesium-137 and strontium-90 contamination in the subsurface, which will be referred to as the hot spot in this plan)
- Infiltration to perched water in conjunction with actions on the soil
- The Snake River Plain Aquifer.

Technologies that may potentially meet the remedial action objectives were identified and screened with respect to their potential effectiveness and technical feasibility. Representative technologies were selected from those retained after screening, and the retained technologies were combined into alternatives, ranging from a limited action alternative to alternatives incorporating containment, removal, and treatment of contaminated soil and groundwater. The range of alternatives was formulated to address constraints on implementability presented by existing and future INTEC infrastructure and operations.

The alternatives were formulated to meet remedial action objectives while adding progressively more protective measures; therefore, some elements are common to several or all of the alternatives. Most alternatives include some actions to be completed once access to the adjacent buildings and other infrastructure, such as buried piping, is no longer needed for ongoing cleanups. This approach was necessary because these infrastructures interfere with and limit remedial options that can be conducted under CERCLA. Figure 4 shows the infrastructure that will remain active beyond 2012. Actions to be completed initially will be fully protective of workers and reduce risks to groundwater. This allows for installation of additional components once the interfering infrastructure is removed or no longer in use, which is estimated to be around 2035. These additional components will also provide long-term protection and reduction of risks to groundwater and future workers while minimizing long-term maintenance requirements. An engineering evaluation will be conducted during the ***remedial design*** phase to determine the more cost-effective option: (a) continue maintaining the Operable Unit 3-14 remedies or (b) modify remedies to reduce the operations and maintenance costs.

The groundwater model predicts that the most effective way to meet the groundwater remedial action objectives is to reduce infiltration of precipitation to 1 mm/year through 10 acres around and including the tank farm. Figure 4 shows this recharge control zone. The modeling also predicts that additional benefit can be achieved by reducing infiltration of water from human activities beneath northern INTEC. Because of practical limitations on achieving an infiltration rate of 1 mm/year in the middle of an operating facility, the Agencies propose to implement additional recharge controls within a larger area. Potential actions to reduce water infiltration and recharge of the perched water zones beneath the northern portion of INTEC were identified in "Methods to Reduce Water Infiltration and Recharge of the Northern Shallow Perched Water Zone at INTEC."[10]

info To fine-tune their evaluation of potential treatment technologies for the INTEC tank farm under the five CERCLA balancing criteria, the Agencies studied more than 20 areas of specific concern. Among them are

- Availability of storage and disposal facilities
- Reliability of the alternative
- Ability to construct and operate
- Monitoring considerations
- Administrative feasibility
- Shipments out of the INL
- Worker protection
- Primary waste volume
- Irreversibility of treatment
- Treatment residuals.

remedial design (RD)
A phase of the CERCLA remedial action that follows the remedial investigation/feasibility study and Record of Decision. It includes development of engineering drawings and specifications for cleanup.

net present value (NPV)
Net present value compares the value of a dollar today versus the value of that same dollar in the future after taking return and inflation into account.

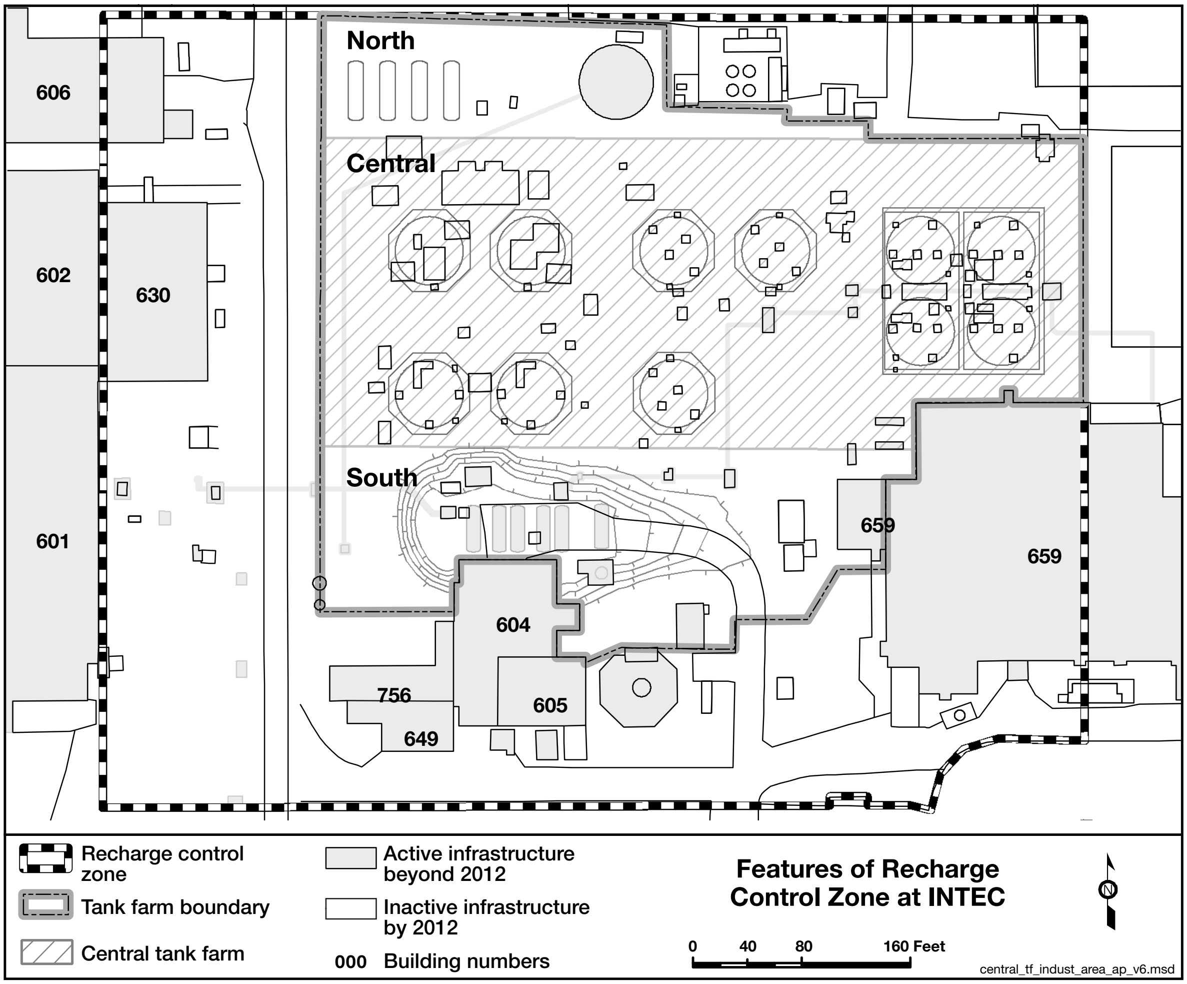


Figure 4. Location of north, central, and south tank farm; recharge control zone; and active infrastructure, including buildings, beyond 2012.

A preliminary cost estimate for these actions is $5.5 million (M) in ***net present value***. The scope, design, and costs will be refined during remedial design. The actions include eliminating unnecessary discharges of clean water to soil, improving the storm water drainage system, and monitoring pipe flows so that leaks can be detected and fixed.

Soil and other media that have become contaminated by contact with sodium-bearing waste or first-cycle waste are considered contaminated media. These will be addressed for purposes of CERCLA remediation based on actual radioactive and chemical characteristics and concentrations of the resulting material, the specific risk the material presents to human health and the environment, and the reasonable alternatives available for reducing that risk. The characteristics and concentrations have been altered over time because the rate of transport through the subsurface, reaction with surrounding materials, and radioactive decay varies by contaminant. Tank farm activities, such as construction, maintenance, and removal of these soils, have further modified contaminant concentrations.

Some Operable Unit 3-13 soil sites are located in the industrial use area. The cleanup of these sites will be to an industrial use standard under OU 3-13. A map showing the location of these sites can be found in the Remedial Investigation/Baseline Risk Assessment[1] on page 4-7.

Most alternatives will be described in reference to the recharge control zone and the central tank farm, which includes CPP-31, where most of the contamination was released from the tank farm to the soil and underlying perched water and groundwater.

The alternatives considered are No Action; Limited Action; Capping and Monitoring; Hot Spot Removal, Capping, and Monitoring; Hot Spot Grouting, Capping, and Monitoring; and Contingent Aquifer Pump and Treat.

No Action Alternative

DOE is required by federal orders and state and federal laws to protect workers and the public from unacceptable exposures, and the INL currently has administrative and physical controls in place to prevent unacceptable exposures to contaminated soil and groundwater. DOE cannot implement

institutional controls (ICs)
Administrative and engineering measures to protect workers from exposure to contamination. Institutional controls may include access restrictions (such as signs) and use restrictions and are maintained until cleanup goals for unrestricted use have been achieved.

Tank Farm Interim Action
Implemented to reduce the infiltration of precipitation through tank farm soil. Operation and maintenance of the Tank Farm Interim Action include inspection and repair of the asphalt, discharge pipes, culverts, lined collection ditches, lift station, and the evaporation pond.

infiltration-reducing cap
A cover over contaminated soil designed to minimize water passing through it. It can be applied over and around infrastructures and repaired if it is necessary to dig through it. Additional measures are necessary to protect workers from external exposure to radiation through excavation because this type of cap has minimal thickness.

evapotranspiration/capillary biobarrier cap (worker protection cap)
A thick soil layer with a vegetated surface designed to minimize precipitation from infiltrating to underlying soil. The plants help pump the uncontaminated water back to the atmosphere. Gravel and cobble layers under the soil layer also prevent biota from penetrating into the waste zone and provide a capillary break to retard downward water movement. The multilayer cap provides for both worker protection and reduces infiltration of precipitation to underlying contaminated soil. It minimizes active controls required for managing storm water. Currently, workers are protected through administrative controls.

a No Action alternative (that is, no controls) because it would put workers at risk and would not meet the requirements of federal orders and state and federal laws. Therefore, the No Action alternative is not considered further.

Alternative 1 – Limited Action: Institutional Controls, Maintenance, and Monitoring

The Limited Action alternative includes ***institutional controls***, maintenance, and monitoring. Institutional controls include restricting access to contaminated soil and groundwater using radiological work controls, fences, signs, and other administrative or engineering measures. Besides these controls, the alternative includes all of the ongoing Operable Unit 3-13 remedies for tank farm soil and groundwater. This entails monitoring of groundwater and operation and maintenance of the ***Tank Farm Interim Action*** to reduce infiltration of precipitation over a portion of the tank farm. The remedial components of Alternative 1 are assumed to be in place until 2095 and are included in all the subsequent alternatives.

These limited actions are not sufficient to meet the remedial action objective to restore the Snake River Plain Aquifer to Idaho groundwater quality standards. Therefore, the Limited Action alternative is not considered further.

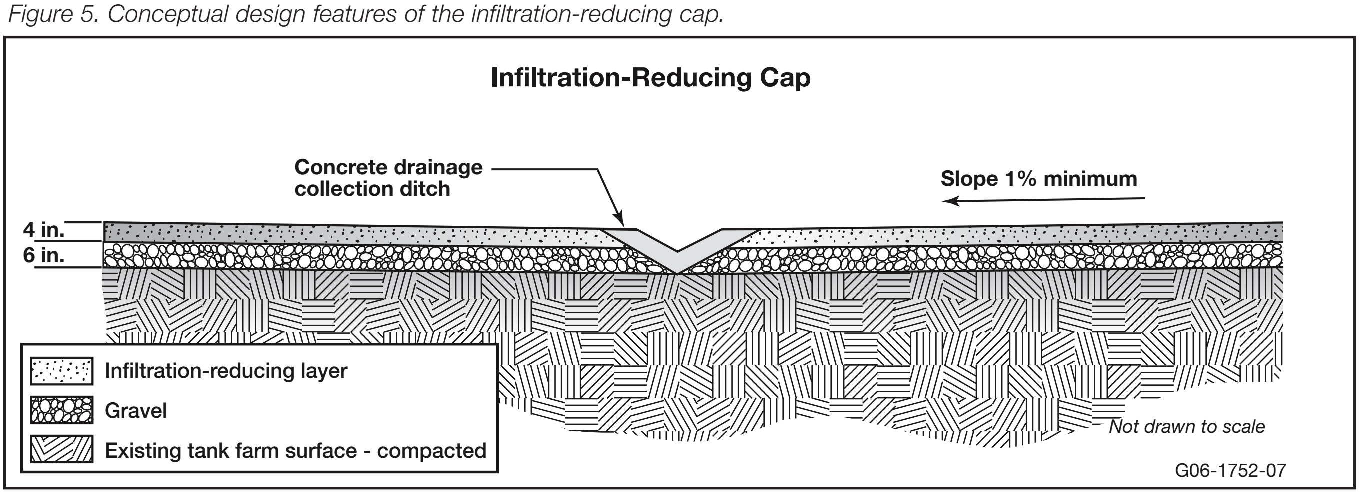
Alternative 2 – Capping and Monitoring

Alternative 2 adds capping to the actions from Alternative 1.

The recharge control zone will be covered almost entirely with an ***infiltration-reducing cap***, the features of which are shown in Figure 5. Because this cap is less than a foot thick, it can be installed around existing infrastructure. This cap requires ongoing maintenance (such as patching) to ensure its effectiveness and use of lift stations to remove surface water accumulating in low areas and to transport the water to a lined evaporation pond. In the north tank farm (see Figure 4 on previous page), workers will remove soil with low levels of contamination before installing the infiltration-reducing cap.

The central and south tank farm will be covered with an ***evapotranspiration/ capillary biobarrier cap*** (referred to as worker protection cap in this Proposed Plan). Figure 6 shows the features of this cap. The worker protection cap varies in thickness from 6 ft at the edges to 18 ft at the crown and will protect workers from external exposure to contaminated soil, reduce water infiltration, and prevent biota from intruding through the cap and bringing contamination to the surface. This type of cap requires less maintenance than the infiltration-reducing cap and does not require lift stations or evaporation ponds for managing surface water. Instead, it

Figure 5. Conceptual design features of the infiltration-reducing cap.



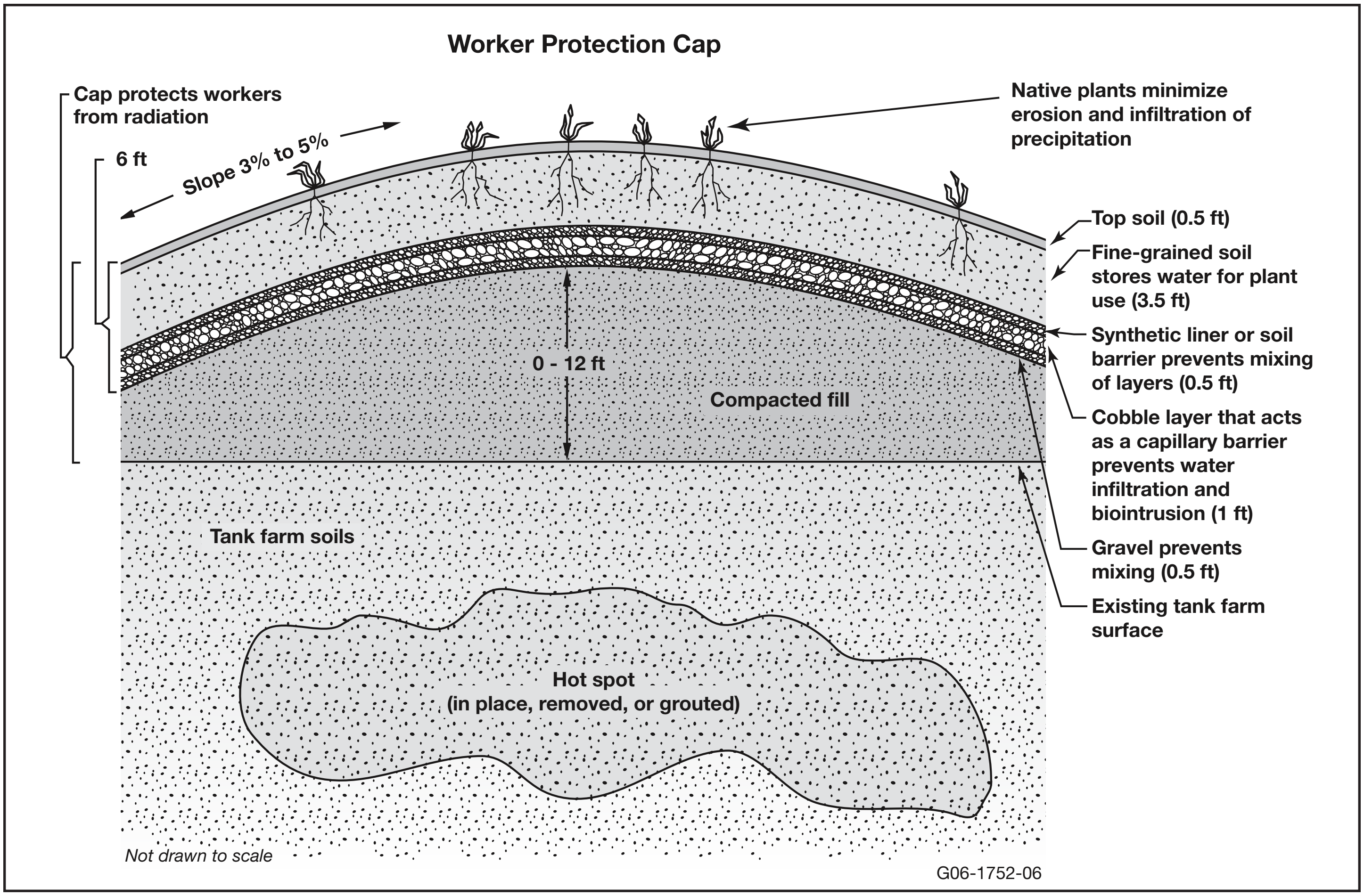


Figure 6. Conceptual design features of the worker protection cap.

minimizes recharge by storing moisture and returning it to the air using plants and evaporation.

Ongoing cleanup activities around the south tank farm, access requirements for building CPP-604, and other infrastructure, including active underground waste lines and tanks (see Figure 4 on page 13), prevent the immediate installation of the worker protection cap over the south tank farm. However, workers will be protected using administrative and engineering controls until the interfering infrastructure is removed as part of cleanups under other programs. Once the interfering infrastructure is no longer needed and demolished, the worker protection cap will be constructed on top of the infiltration-reducing cap over the south tank farm.

Alternative 2a – Capping and Monitoring. Alternative 2a remedial activities would be completed while interfering infrastructures are still in use and before they are removed, with the exception of the south tank farm (see the top of Figure 7 on next page).

Preferred ☑ *Alternative 2b – Capping and Monitoring.* Alternative 2b is similar to Alternative 2a, with one exception—the worker protection cap will be constructed on top of the infiltration-reducing cap over the central tank farm (see Figure 7 on next page) once interfering infrastructure is no longer needed and demolished.

The completed Alternative 2b and 2a caps are planned to be the same. However, under Alternative 2b, the worker protection cap would be installed over both the central and south tank farm at one time and there would be an inactive surface

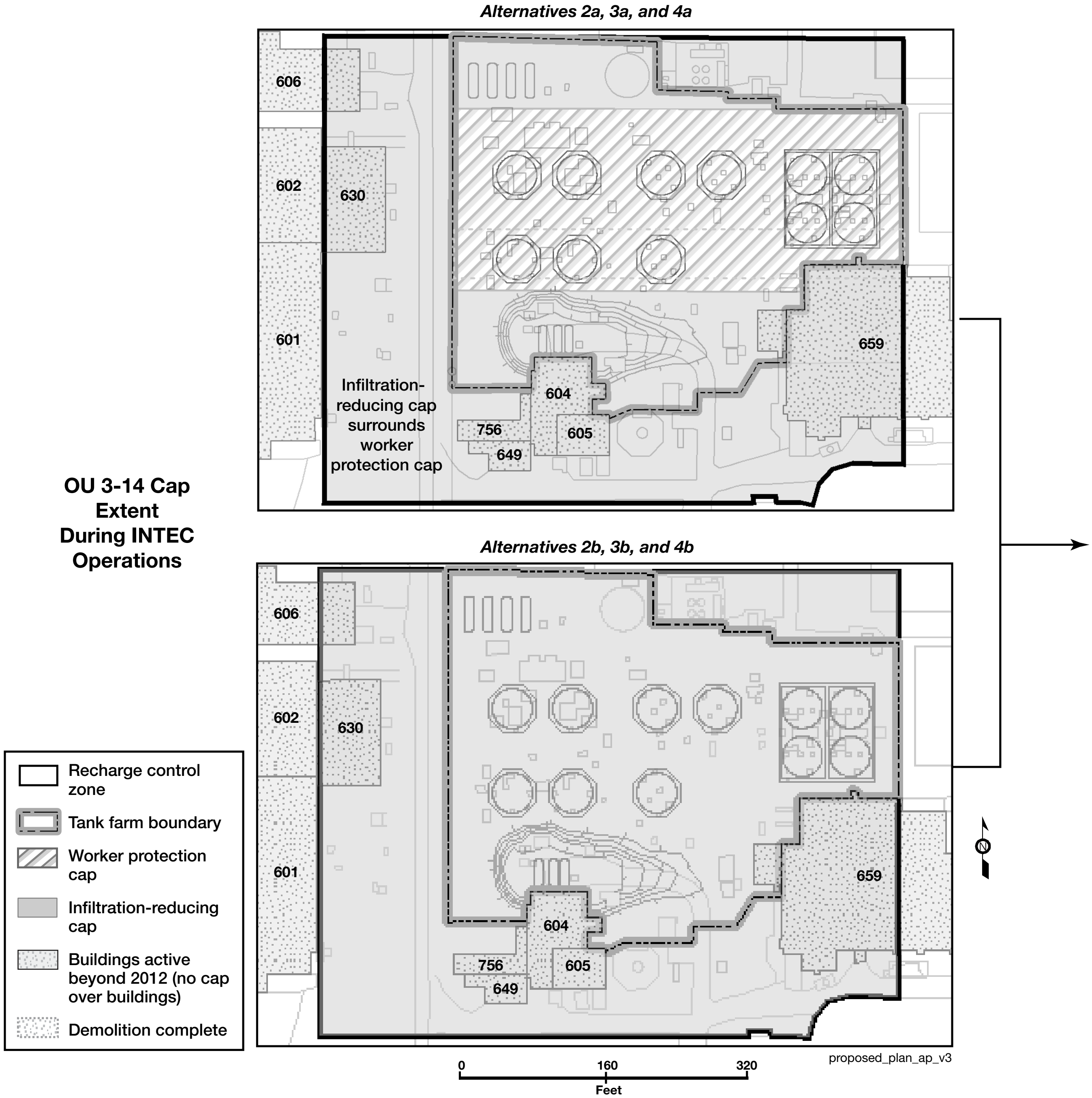


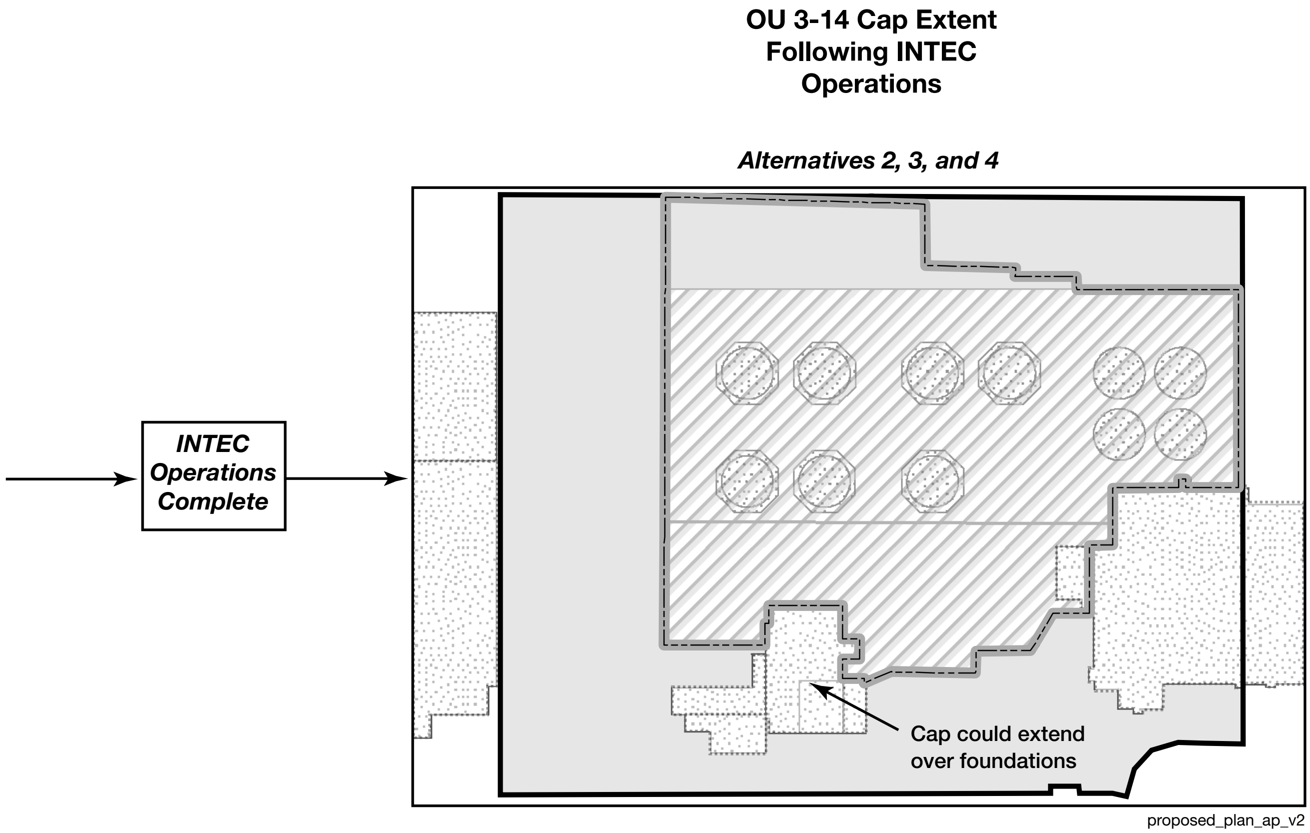
Figure 7. Cap extent for Alternatives 2 through 4 during (shown above) and following facility operation (shown on next page).

alpha particles
Highly charged particles with a large mass emitted from a radioactive atom. Alpha particles deposit a large amount of energy in a short distance of travel. They have limited penetrating ability (about 1–2 in. in air) and are easily stopped by a sheet of paper or the outer layer of dead skin. If inhaled, they can become an internal source for exposure and can deposit large amounts of energy in a small volume of body tissue, such as the lungs.

to work on. The worker protection cap could be extended over a larger area and combined with other caps if more cost effective than maintaining the infiltration-reducing cap.

Alternative 3 – Hot Spot Removal, Capping, and Monitoring

Alternative 3 adds removal and disposal of contaminated soil in CPP-31 to Alternative 2. CPP-31 was the largest source of contaminants released to the underlying basalt, perched water, and groundwater. Removal of contaminated soil will require worker protection not only from gamma radiation, but also from alpha radiation, because radionuclides, such as plutonium, that emit ***alpha particles*** are in the soil. As a result, excavation would likely be performed using remote handling



techniques inside an enclosed area, such as a tent, which complicates the alternative. Because excavation using remote handling techniques would be to 60 ft deep in some areas, but limited horizontally to 50 ft due to the distance between tank vaults, ramps and shoring would be required, which also increases the complexity. The excavation would need to work around the buried pipes, valve boxes, tanks, and vaults, many of which will be grouted under HWMA/RCRA.

Alternative 3a – Hot spot removal, 2a capping, and monitoring. Alternative 3a remedial activities would be completed before interfering infrastructures are removed or while they are still in use.

Alternative 3b – Hot spot removal, 2b capping, and monitoring. Alternative 3b is similar to Alternative 3a, but the remedial activities would be completed after infrastructure is removed or is no longer in use.

Alternative 4 – Hot Spot Grouting, Capping, and Monitoring

Alternative 4 adds grouting at CPP-31 to Alternative 2. The soil, which occupies roughly 160 × 50 × 50 ft, will be grouted in place. Grouting of contaminated soil presents challenges beyond those for grouting the cleaned tanks and tank vaults, which will be performed under HWMA/RCRA closure. As a result of ensuring that voids are permeated with grout, some grout material (estimated at 10%) will be brought back to the surface. The grout returns from the soil will be contaminated and will need remote handling; therefore, soil grouting requires increased work

info The Idaho CERCLA Disposal Facility (ICDF) was selected as the disposal facility for INL CERCLA waste while the facility is open. Laboratory analyses of soil samples indicate OU 3-14 waste will meet the Waste Acceptance Criteria for the ICDF. Once the ICDF is closed, waste that may be generated, such as ion exchange resins from pumping and treating groundwater, will need to be disposed of elsewhere.

controls and an enclosure to protect workers. Because of buried and surface infrastructure in the area, only about 55% of the grout holes are expected to reach all the way to basalt. Therefore, the volume of soil that can be successfully reached by the grout is less than 100%.

Alternative 4a – Hot spot grouting, 2a capping, and monitoring. Alternative 4a remedial activities would be completed before interfering infrastructures are removed or while they are still in use.

Alternative 4b – Hot spot grouting, 2b capping, and monitoring. Alternative 4b remedial activities would be completed after infrastructure is removed or no longer in use.

Alternative 5 – Contingent Aquifer Pump and Treat

Alternative 5, Contingent Snake River Plain Aquifer Pump and Treat, was evaluated in the Feasibility Study[2] but is not compared to other alternatives in the Proposed Plan because it is not a stand-alone remedy. The contingent pump and treat alternative would only be implemented if, after implementation of one of the other remedies, monitoring results indicated that Idaho groundwater quality standards might not be met during the restoration timeframe. However, removal of strontium-90 from the water using this method is inefficient using current technologies. The Agencies did not consider pump and treat of the perched water because it can only be pumped at a few gallons per minute, and the pumping rate cannot be sustained.

Table 3. Comparison of alternatives.

Evaluation of Alternatives [a,b]

	Limited Action	Capping and Monitoring		Hot Spot Removal, Capping, and Monitoring		Hot Spot Grouting, Capping, and Monitoring	
CERCLA Evaluation Criterion	1	2a	☑ 2b	3a	3b	4a	4b
Protect human health and environment	No	Yes	Yes	Yes	Yes	Yes	Yes
Meet ARARs	No	Yes	Yes	Yes	Yes	Yes	Yes
Long-term effectiveness and permanence	c	◒	◒	◒	◒	◒	◒
Reduce toxicity, mobility, and volume through treatment	c	○	○	○	○	◒	◒
Short-term effectiveness	c	●	●	○	○	◒	◒
Implementability	c	◒	●	○	○	○	◒
Total project cost [d]	$3.3M	$12.2M	$9.0M	$43.1M	$27.5M	$16.1M	$11.3M
Capital cost [d]	$0	$6.9M	$3.7M	$37.8M	$22.2M	$10.8M	$6.0M
Operation and maintenance (O&M) cost[d]	$3.3M	$5.3M	$5.3M	$5.3M	$5.3M	$5.3M	$5.3M

a. This table does not include the infiltration controls discussed on page 12.
b. Alternative 5 is not evaluated in the Proposed Plan because it is not a stand-alone alternative and does not meet threshold criteria.
c. Alternative 1 does not meet the threshold criteria, so it is not evaluated for balancing criteria in the Proposed Plan.
d. Net present value in 2006 dollars. Net present value adjusts the value of a dollar today by the value of that same dollar in the future after accounting for return and inflation. The costs have an estimated accuracy of +50 to -30%.

☑ = *The preferred alternative*
● = *High ranking*
◒ = *Medium ranking*
○ = *Low ranking*

Evaluation of Alternatives

The alternatives were evaluated against the CERCLA criteria. Table 3 shows how the alternatives compare to each other.

Overall protection of human health and the environment and compliance with ARARs – Alternatives 2 through 4 meet threshold criteria and are compared to each other in Table 3. Alternative 1 (Limited Action) is not compared because it does not meet the threshold criteria. Table 3 does not rate Alternative 5 because it is not a stand-alone alternative. By itself, it would not meet threshold criteria because it does not protect workers from external exposure to radiation.

Long-term effectiveness and permanence – Alternatives 2 through 4 had medium long-term effectiveness and permanence. This criterion applies to the soil and the Snake River Plain Aquifer. The long-term worker exposure to the soil is controlled by the cap and/or administrative controls, which are about the same for each alternative. The alternatives also result in roughly equivalent long-term effectiveness and permanence for the Snake River Plain Aquifer. Removing (Alternative 3) or grouting (Alternative 4) CPP-31 soil was predicted by modeling to have only a slight effect on strontium-90 concentrations in the Snake River Plain Aquifer. Thus, recharge control by capping, implemented under Alternatives 2, 3, and 4, would provide adequate long-term effectiveness and permanence for the soil and for the Snake River Plain Aquifer until the Idaho groundwater quality standard for strontium-90 is met, which is predicted to be by 2095. All alternatives include groundwater monitoring for OU 3-14 contaminants to ensure Idaho groundwater quality standards will be met in the Snake River Plain Aquifer by 2095.

Reduction of toxicity, mobility, and volume through treatment – Alternatives 2 and 3 (*a* and *b*) do not involve treatment and are ranked low on this criterion. Alternative 4 (*a* and *b*) includes treatment but would do little to reduce the strontium-90 risk to the Snake River Plain Aquifer. Alternative 4, which is rated medium, would produce secondary wastes, including grout returns.

Short-term effectiveness – None of the alternatives would result in short-term risks to the public or the environment because administrative and engineering controls would be used to evaluate and mitigate risks prior to and during implementation of the remedy. Short-term effectiveness for Alternative 2 (*a* and *b*) would be high because only a limited amount of soil would be excavated and capping would result in limited exposures. Short-term effectiveness is low for Alternative 3 because of the increased risk of exposure to workers during excavation. CPP-31 soil at depth has very high concentrations of cesium-137, which emits gamma rays and also contains alpha-emitting contaminants. When this soil is removed and brought to the surface, it could expose workers to unacceptably high doses of radiation, as well as internal alpha contamination if they inhale dust. Short-term effectiveness is medium for Alternative 4 because there is some increased risk of exposure to workers during grouting. The grout returns (about 10% of the volume) will contain cesium-137 and pose a risk to workers. Cesium-137 is bound up in the soil and removal or grouting was predicted by groundwater modeling to only slightly reduce the overall risk to the Snake River Plain Aquifer. Alternatives 3 and 4 would increase the risk of external radiation exposure to workers for limited reduction in overall risk to the aquifer.

Implementability – Alternative 2*b* is the only alternative with a high rating for implementability because capping would not require digging or drilling into the hot spot, and the final worker protection cap would be implemented on the central tank farm when INTEC operations have ended and interfering surface infrastructure has been removed. Alternatives 2*a* and 4*b* are rated medium on implementability because they either have to install the worker protection cap over the central tank farm while the interfering infrastructure is still being used (2*a*) or drill into the hot spot (4*b*). Removal of the hot spot is rated low (Alternatives 3*a* and 3*b*) because of the high radiation levels, the need for containment of radioactive emissions, the depth of the excavation required (up to 60 ft), and the small space between tanks to work. Alternative 4*a* is also rated low for implementability because of (a) the combined complexity of drilling into the hot spot with existing INTEC infrastructure still operating and (b) capping the central tank farm with a worker protection cap up to 18 ft thick in the middle of active buildings and over active waste lines and valve boxes.

Cost – Table 3 includes the cost of Alternatives 1 through 4. The range is $3.3M for limited action to $43M for hot spot removal (Alternative 3*a*). Costs for each alternative are calculated in terms of net present value, within an estimated accuracy of +50% to -30%. Costs are broken out as capital and operation and maintenance (O&M) costs. Capital costs are those required to design, construct, and operate the facilities necessary for the remedial action and the costs to perform short-term remedial action. They include the costs of project and construction management, design, construction, and short-term operations. O&M costs cover the labor and maintenance required for long-term remedial action operations, long-term maintenance, and institutional controls. Periodic costs, which include 5-year reviews required under CERCLA and other recurring costs, are contained in the O&M costs shown in Table 3. Costs were calculated for the duration of the remedy. More details on costs can be found in Appendix B of the feasibility study.[2]

PREFERRED ALTERNATIVE 2b – *Infiltration-Reducing Cap followed by Worker Protection Cap when Infrastructure Removed, and Monitoring*

Of the viable alternatives (2 through 4), only Alternative 2*b* is ranked high on both short-term effectiveness and implementability. Because of concern for worker safety and to minimize risk to workers while protecting the Snake River Plain Aquifer for future use as a drinking water source, the Agencies' preferred alternative is Alternative 2*b*. The preferred alternative would protect human health and the environment and comply with ARARs.

The preferred alternative would reduce contaminant migration to the Snake River Plain Aquifer sufficiently to attain Idaho groundwater quality standards by 2095 and prevent gamma radiation exposures to current and future workers. Alternative 2*b* is equally protective to Alternatives 2*a*, 3, and 4 because (1) the infiltration-reducing cap is a barrier to infiltration and biotic intrusion similar to the worker protection cap and (2) the workers are protected using administrative and engineering controls until the worker protection cap can be constructed. This alternative is the safest for workers and is most implementable of all alternatives that meet threshold criteria.

Based on the information available at this time, the Agencies believe the preferred alternative would be protective of human health and the environment, would comply with ARARs, would be cost-effective, and would use permanent solutions and alternative treatment technologies to the maximum extent practicable. The preferred alternative may be modified or changed by the Agencies in response to public comment or new information that becomes available after this plan is released. The Agencies deem it necessary to implement the preferred alternative for tank farm soil and groundwater identified in this Proposed Plan to protect public health and welfare from actual or threatened releases of radionuclides into the environment.

If new technologies or improvements to the pump and treat technologies are developed in the future that would significantly enhance the ability to achieve remedial action objectives, the Agencies could amend the Record of Decision to change the remedy. CERCLA requires reviews at least every 5 years to ensure that the remedy is protective of human health and the environment and is functioning and operating as designed.

info After a Record of Decision is signed, new information may become available that could cause the Agencies to reassess the remedy. For example, if a new technology is developed that could achieve remediation goals faster, better, or for less cost, a process exists under CERCLA to alter the Record of Decision. In addition, under CERCLA, the Agencies review the remedy at least once every 5 years to ensure that the remedy is protective, although the Agencies can evaluate whether a remedy change is warranted at any time. This flexibility under CERCLA ensures that a Record of Decision can be changed when necessary to ensure that the remedy is protective or to improve the remedy.

REFERENCES

This list of source material is provided for readers who want more detailed information than is presented in this Proposed Plan. These documents are available in the Administrative Record or other federal archives as indicated. Locations of the Administrative Record are listed in the margin of this page.

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info The Idaho Cleanup Project Administrative Record is available to the public at the following locations:

INL/Idaho Cleanup Project Technical Library
DOE Public Reading Room
1776 Science Center Drive
Idaho Falls, ID 83415
208-526-1185

Albertsons Library
Boise State University
1910 University Drive
Boise, Idaho 83725
208-385-1621

The Administrative Record may also be accessed on the Internet at http://ar.inel.gov.
Any library with Internet access can connect you to the Administrative Record.

info Information about the Idaho Cleanup Project at the INL is available on the Internet at http://idahocleanupproject.inel.gov

The Agencies

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More Information

Contact: Erik Simpson, the ICP Community Relations representative for the Idaho Nuclear Technology and Engineering Center, at 208-526-4700 or at erik.simpson@icp.doe.gov.

For general information, visit http://idahocleanupproject.com, call 1-800-708-2680, or send mail to P.O. Box 1625, MS 3206, Idaho Falls, ID 83415-3206.

PUBLIC INVOLVEMENT

The public comment period for this Proposed Plan extends from August 22 through September 21, 2006. Citizens are encouraged to review this Proposed Plan, attend a public meeting or briefing, and provide comments.

Community acceptance is an important criterion in the evaluation of the CERCLA alternatives. The Agencies will review and consider comments from citizens about this Proposed Plan and may modify the preferred alternative presented in this plan based on the comments that they receive. Agency responses to all comments on this plan will be published as part of the Record of Decision for OU 3-14, which is scheduled to be completed in 2007.

Two public meetings will be held during the public comment period. They will be held in Idaho Falls on August 29, 2006, at the Shilo Inn, 780 Lindsay Boulevard, and in Twin Falls on August 30, 2006, at the Taylor Student Union Building at the College of Southern Idaho, 315 Falls Avenue. The meetings will be held from 6:00 p.m. to 8:00 p.m. with an opportunity for informal discussion with Agency and project representatives. A court reporter will record formal public comments and the transcripts will be placed in the Administrative Record.

Written comments can be submitted to one of the project representatives at the meeting or mailed. A form is included in this Proposed Plan for your convenience. Written comments can be mailed to the name and address specified on the form:

Nolan R. Jensen, Idaho Cleanup Project,
DOE Idaho Operations Office, MS 1222
P.O. Box 1625, Idaho Falls, ID 83415-1222.

This Proposed Plan and a form for submitting comments are also available online at http://idahocleanupproject.com. To arrange briefings in other communities, call the ICP's toll-free number, 1-800-708-2680.

Public Meetings
AUGUST 2006

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	**29**	**30**	31		

Idaho Falls
Tuesday, August 29, 2006
6 to 8 p.m.
Shilo Inn
780 Lindsay Blvd.

Twin Falls
Wednesday, August 30, 2006
6 to 8 p.m.
Taylor Student Union Building
College of Southern Idaho
315 Falls Ave.

Comments (continued)

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Please return this form by September 21, 2006

Tell Us What You Think

*The Agencies want to hear from you to decide what actions to take for the Tank Farm Soil and Groundwater at the Idaho Nuclear Technology and Engineering Center, Operable Unit 3-14.**

Comments ______________________________

** If you want a copy of the Record of Decision and Responsiveness Summary, please make sure your mailing label is correct.*

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